CHAPTER 10

Other Issues

10.1. Patent Issues. As a matter of limiting government liability, project managers should refrain from requiring particular methods or specific technologies in their solicitations for bids. However, if these technologies or methods must be identified, vendors should be required to (1) acquire all necessary licenses for patented technologies employed to perform the work, (2) investigate any licensed patents to verify the absence of Government rights clauses that would preclude the need for a license or payment of royalties for work done for the Government, and (3) hold the Government harmless for infringement of patents, copyrights, trademarks, and trade secrets resulting from performance of the work. The appropriate Office of Counsel should be consulted with regard to the proper application of patent law in these solicitations.

10.2. Safety.

10.2.1. *Thermal Conductive Heating*. Two specific areas of potential concern are exposures to high voltages and temperatures. These are addressed separately in the following paragraphs.

10.2.1.1 Electrical work is performed in accordance with the National Electrical Code (NEC, NFPA 70). Electrical wiring, including connection to the high voltage (primary) power supply, wiring from the high voltage supply to the transformer, and from the transformer to the electrical distribution panels, connecting power wiring to the off-gas treatment equipment, and wiring of the heaters is performed by a licensed electrician. To protect against worker injury in the event of an electrical fault with the heater elements, the heater cans, well screens, and metallic process piping are bonded together with an appropriately sized copper conductor, which is connected to an earth ground (i.e., ground rod). In addition, metallic instrumentation ports installed within the soil (e.g., temperature and pressure monitoring ports) are bonded to an earth ground. The main transformer and electrical distribution gear are connected to an earth ground as required by the NEC. To minimize the potential for worker exposure to energized electrical sources, access to the electrical distribution panel and the heater element electrical junction boxes is restricted to authorized personnel only. Electrical components are equipped with appropriate warning labels (e.g., high voltage, etc.) as required by the NEC.

10.2.1.2. Appropriate measures are taken to protect on-site workers from incidental contact with exposed hot surfaces. Exposed hot surfaces may include the process piping and certain components of the off-gas treatment equipment. Surfaces that are expected to exceed 60°C (140°F) are covered with insulation or otherwise protected with a guard where insulation is not practical. In addition, personnel working in areas where incidental contact with hot surfaces 60°C (140°F) may be possible, wear leather gloves. In some instances, exposure to hot material or components is unavoidable. Such circumstances may include, but are not limited to, collection of soil or groundwater samples during the ISTD heating process (if required), and replacement of ISTD heater elements (if required) during heating. In these instances, only trained personnel are allowed in the work area. Worker protective measures are selected in accordance with the potential heat exposure. At sites having buried ordnance or sealed vessels, that might generate explosive pressures when exposed to high temperatures, special precautions are needed to exclude personnel from the vicinity during heating. These precautions include removing the UXO (refer to ER 385-1-95, paragraph 6.c), by an UXO qualified contractor, from the known subsurface footprint of the project prior to installing the equipment or having a UXO qualified contractor on stand-by and OE Safety Specialist (refer to EM 385-1-97, Chapter I, paragraph 1.A.02.02 and Chapter III), or both. An Explosives Site Safety (ESS) Plan will be required (per EM 385-1-97, Appendix Y) for UXO contractor support. During equipment installation and operation it is required to have a UXO qualified contractor support on standby as well as an OE Safety Specialist.

10.2.2. *Electrical Resistance Heating*. Safety precautions for working in an area undergoing treatment using ERH are similar to that involving TCH. All applications of ERH follow OSHA requirements that surface voltages be less than 15 V. This makes it possible for workers to enter the area undergoing treatment without the need for special protection. Lock-out tag-out procedures are followed should there be any need to access or touch wells, electrodes, work with equipment, or perform any intrusive work. The surfaces are hot, but can be safely accessed using work boots and leather gloves. Because of the presence of cables and piping to the various electrodes and recovery wells, slip, trip, and fall hazards are of particular concern, which may result in burns or scalds if unprotected parts of the body come in contact with hot surfaces.

10.2.2.1. Subsurface intrusive activity can be safely performed during ERH treatment. Procedures followed involve coordinating with the technology vendor for shutting down the power 24 hours in advance of the intrusive activity. Electrical current quickly dissipates, but time should be allotted to dissipate pressures that may have built up in the soil as a result of heating. Vapor recovery operations are typically maintained to promote dissipation of pressures in the soil. Vendor lock-out tag-out procedures are followed to ensure no startup of operations occurs during intrusive activities. Soil sampling equipment and soil cores are handled using leather gloves.

10.2.3. *Steam Enhanced Extraction*. Safety concerns in working in and around areas being treated using SEE methods are similar to TCH and ERH. The major difference is steam is being distributed to wells rather than electricity being distributed to heater wells or electrodes. The steam distribution piping represents additional hot surfaces that are under pressure, which in turn provides greater opportunity for burns and scalds to workers in the area. Further, steam injection typically involves the use of steam traps in the distribution lines, and blow down points on the generators and piping to ensure distribution of high quality steam to the subsurface. This requires workers to interact more with the equipment than is typically required for either TCH or ERH operations. Site workers need to follow local boiler code requirements, which may require 24-hour oversight of activity. All piping should be labeled. Steam piping is typically insulated and jacketed.

10.3. <u>Community Acceptance and Education</u>. Implementation of ISTR at a site raises specific community concerns that are important to address as part of community outreach efforts. The responsibility for any outreach efforts rests with the project manager with support from the Public Affairs Office.

10.3.1. Specific concerns commonly expressed by local communities in relation to ISTR are:

a. Noise during construction and operation.

b. Odor during construction and operation.

c. Increased traffic in the vicinity of the site.

d. Dust during construction and operation.

e. Emissions from treatment units.

f. Concerns about dioxin creation.

g. Incomplete capture of contaminants.

h. Uncontrolled mobilization of NAPL into previously clean areas (i.e., "making it worse") during thermal treatment.

i. Uncertainties associated with the definition of DNAPL areas for treatment.

j. On-site and off-site management of process wastes.

10.3.2. Under regulatory programs such as Superfund, a proposed plan or other decision document is typically released for public comment prior to selection of a thermal remedy. As a result, many community concerns related to implementation of the remedy may be known ahead of time. However, additional community outreach may be conducted during the design phase to address specific issues raised by the local community before the start of remedial action. Prevention and mitigation measures can then be targeted toward these concerns.

10.3.3. It is important to determine the most appropriate communication methods for the local community (e.g., if translation of ISTR technical information for non-English speaking residents is necessary). It is useful to prepare a community relations plan, or update an existing one, that outlines a communication strategy specifically applicable for thermal technologies.

10.3.4. Standard community outreach tools that can be used before and during the remedial action include community interviews, community meetings, workshops, and fact sheets. Updates to explain air monitoring results are especially important during ISTR implementation.

10.3.5. When appropriate, promptly distribute monitoring results to the community for ISTR applications. Site-specific websites are valuable in providing the community with timely updates and monitoring data.

10.3.6. A useful EPA resource provides a brief explanation of how thermal treatment methods work and defines terms associated with the process (USEPA 2001).

10.4. Contracting. An ISTR can be acquired in a number of different ways. The appropriate means depends on the site conditions, nature of funding, goals and constraints, technical capabilities of the organization seeking the service, and the wishes of the facility at which the remediation is done. Site conditions and goals for remediation affect the number of applicable technologies, which in turn affects the strategy for seeking potential contractors (e.g., sole source selections vs. multiple proposers). The knowledge of site conditions greatly affects the approach and cost. Depth, volume, and required temperature drive ISTR costs. The nature of the funding, such as the amount of available funds at different points in the remediation, can result in a complete construction and operation contract or individual contracts for pieces of the remediation. The more technically capable the staff of the organization seeking the ISTR service, the more detailed or specific the contract can (though not necessarily has to) be. The needs of the facility at which the remediation is to occur may alter the schedule or sequence of the remediation to accommodate other industrial activities, property transfer, etc. Additional considerations are discussed below.

10.4.1. *Planning for Contracting.* Once it becomes clear that ISTR is at least a possibility, the planning for the acquisition of these services should begin. The project manager should include contracting specialists on the project delivery team (PDT). The PDT must develop an acquisition plan (as part of the project management plan that reflects the specifics of the project) (U.S. Army Corps of Engineers, Engineer Regulation, ER 5-1-11). The technical staff for the project should participate in this planning to assure that the contracting approach accounts for the complexities inherent in the application of these innovative technologies and to help identify the realistic goals, schedules, and level of technical detail of the contracting package. A representative of the installation should also be a member of the PDT and the contract planning team to assure their needs are addressed and to assess impacts of funding availability. The appropriate Office of Counsel should always be consulted with regard to the selection and terms of the proper contract vehicle. The planning should identify the appropriate contracting approach, schedule, potential bidder lists, identification of funding constraints (including necessary contingencies given funding uncertainties and potential cost growth), and need for sequencing of remediation or the use of pilot testing.

10.4.2. *Contracting Approaches*.

10.4.2.1. *Invitation for Bid vs. Request for Proposal and Performance: Specifications*. There are many contracting tools available to obtain remediation services. The contract documents may include highly detailed plans and specifications geared to one specific technology or may be general, with detail only on the site conditions and goals. A detailed and specific package would be expected with an invitation for bid (IFB) contract approach and requires a technical staff with a high degree of familiarity with the engineering of ISTR. A more general performance specification contract would be issued as a request for proposal (RFP). The use of a performance specification allows the proposers to use their skills and creativity to develop an approach to reach the specific goals using their technology or a combination of technologies. Such a performance specification is more widely applicable for such innovative technologies such as ISTR, but requires a carefully developed statement of expected performance. Such a statement would clearly indicate the required depth, volume, temperature, duration, and residual concentrations, with clear means to measure and verify achievement of these requirements. If performance-based contracting for such innovative services fails, it is often because of the unclear requirements and a lack of quantifiable performance metrics.

10.4.2.2. *Contracting Tools*. The services can be obtained through a pre-existing indefinite-delivery type (IDT) contract or can be advertised specifically for the site. If done through an existing IDT contract, the prime contract would access the specific ISTR vendor or vendors. Such an arrangement often speeds the process, though it adds the oversight costs from the prime contractor. If a site-specific contract is sought for the ISTR, the contracting team must determine if more than one ISTR technique may work. If only one technique would be appropriate, the number of potential vendors would have to be identified. If only one vendor is available, the contract could be sent to the sole source with adequate justification for the exclusive contract. Without adequate justification, a protest from other vendors may occur and may delay the entire project. The contracting approach should encourage competition to the extent possible. The contracts can be issued as firm-fixed-price, cost-plus award fee, fixed-price plus incentive fee, or other under other terms. The USACE does not typically use time and materials-type contracting. Fixed-price contracts would only be appropriate for extremely well defined problems, and are often plagued by contract claims for changed site conditions or other changes that alter the requirement or schedule. Cost-plus-award fee contracts may be best for sites that are subject to significant quantity uncertainties, as is typically the case for hazardous waste site remediation, but are subject to increases in necessary funding during remediation depending on the actual conditions encountered. The trade-off is often higher characterization costs vs. higher uncertainty in necessary funding. Fixed-price plus incentive fee may be an alternative where the site conditions are moderately well known. In this case, the contractor bids/proposes a fixed-price, but if the costs incurred end up being less (because of innovative work by the contractor or better than expected site conditions), the cost savings are shared between the contractor and the Government. In most cases, options for additional volumes, depths, or duration of heating can be included in the contract and can set a cost basis for any additional effort required by site conditions. Such options provide a great deal of flexibility in reducing cost uncertainty with imperfectly known site conditions.

10.4.2.3. *Construction vs. Service Contracts*. Given the fact that in many cases the costs for operations of ISTR exceed the costs for constructing the relatively fixed features of the remediation (e.g., piping, wells), the contract may be considered a service contract rather than a construction contract. The net result of issuing the contract as a service contract is that lower service labor rates can be used on Federal contracts. Federal construction contracts must use Davis-Bacon wage rates. Service contracts can only be used where the “preponderance” of the work is in the operations rather than construction of fixed or permanent features. The appropriate Office of Counsel should always be consulted with regard to the selection and terms of the proper contract vehicle

10.5. Equipment Purchase, Operations and Maintenance. The above-ground equipment used in the ISTR is typically provided by the contractor rather than purchased by the Government owing to the relatively short time the equipment would be used. In circumstances where the treatment equipment may be needed for a longer time following cessation of ISTR, such as where pump-and-treat may be required for some lengthy time following ISTR, the needed equipment would be best purchased by the Government. If the ISTR contract was not for a complete remediation, including operation, or if the operation was bid as a separate item, the basis for operation costs must be identified. Payment for operation can be based on documented energy input, mass removed, time of actual and successful operation and diligent effort for repair, simple time, or actual cost. All these parameters must be quantifiable and clearly defined. For example "successful operation" can be difficult to define for thermal methods as processes associated with the high temperatures will persist even when energy input may not be occurring. The treatment process must meet discharge requirements, usually expressed as concentration or mass discharge limits. Using time as a sole basis for payment is not recommended, as there is no incentive to be efficient. Mass removal is difficult (and not recommended) to use as a sole cost basis, though it is easy to measure, as the initial mass is typically impossible to estimate with any accuracy and does not reflect costs associated with heating the subsurface. Mass recovery tends to decline over time, so the payment would decrease as treatment progressed. Costs for treatment can be based on the mass removed. Energy input is a good measure for costs associated with subsurface heating, but may not reflect treatment costs. Some combination of these criteria may be a reasonable approach for paying for operations and maintenance. Contracting for the entire project, especially as a performance specification, avoids the difficulties in quantifying and paying costs for operations.

10.6. Regulatory Issues.

10.6.1. *Introduction*. There are a variety of regulatory concerns that may be associated with the implementation of an ISTR project. The introduction of heat, in the form of steam or electrical energy, into contaminated groundwater can significantly alter the subsurface biogeochemical conditions. While the injection of steam can enhance recovery of DNAPL and offers significant benefits, its use may be restricted or prohibited by regulatory or procedural barriers in certain states. To facilitate regulatory acceptance, it is important for regulators to be part of the team that originally selects ISTR as a remedy and to remain involved in the design and implementation phases. If specific permits are not required, review and approval of the work plans are typically the formal mechanism by which regulatory approval is obtained. The appropriate Office of Counsel must be consulted with regard to the proper application of the laws and requirements under the various regulatory programs. There may be differences in application between the various Defense programs.

10.6.1.1 After consulting with the Office of Counsel and during the planning phase, the project team should consider and incorporate specific regulatory issues and requirements into the conceptual design. The most important and contentious issue to be resolved during the early phases of design is establishing appropriate remedial action objectives. Regulatory agencies should be involved in the development of RAOs from the outset because they are accountable to the public for the outcome of the cleanup project as discussed in Paragraph 4-2. The Office of Counsel should always be consulted closely with regard to compliance issues and regulatory requirements and should be the lead in dealing with regulatory agencies on such matters as permitting. This paragraph focuses on other items of concern to regulators including:

a. Permits needed for discharges to the environment.

b. Establishing air emissions limits.

c. Permits needed for treated water disposal.

d. Preventing uncontrolled migration of contaminated groundwater and vapors.

10.6.2. *Permitting of Discharges to the Environment*. There are differences in regulatory requirements based on whether the site is regulated under state or Federal law, the regulatory program (e.g., RCRA or CERCLA), and the type of site (a Federal facility, a Superfund site, state lands, or private property). While permit requirements are not a direct barrier to the deployment of thermal treatment technologies, it is important that the technology user be aware of state-specific permits and requirements.

10.6.2.1. For remedial projects involving discharges to the environment, the regulatory authority will likely specify limitations on the amount of contamination discharged to the air, water, or sewers. Permitting varies, as each project site is different. Under CERCLA, permit requirements are typically waived for remedial activities; however, the substantive technical requirements as specified by the regulatory authority for that action must be met. Likewise, permits may not be required for most sites under state oversight, although projects would still have to meet the substantive technical requirements of state regulations.

10.6.2.2. For ISTR projects, contaminated waste streams and processes that would typically require some form of discharge limitation include air emissions, surface water discharges, sewer discharges, and discharges to groundwater for any subsurface injection or activity that raises groundwater contamination above standards or background concentrations (if higher than standards). Depending on the regulatory situation, a RCRA permit may be required for treatment operations that involve managing hazardous waste.

10.6.3. *Underground Injection Control (UIC)*. For CERCLA sites, the remedial alternatives must satisfy applicable or relevant and appropriate requirements (ARARs). Non-CERCLA sites (RCRA sites, privates sites, state Superfund sites, Federal facilities, etc.) may also have potentially applicable regulations at the state and Federal level. In particular, Underground Injection Control (UIC) regulations may be applicable for both CERCLA and non-CERCLA sites.

10.6.3.1. The UIC program, under the Federal Safe Drinking Water Act, regulates injection wells. Under the UIC program, injection of any fluid into a well is prohibited, except as authorized by permit or rule. The purpose of the UIC program is to protect underground sources of drinking water by prohibiting injection that may affect water quality. State UIC programs may be delegated complete or partial enforcement responsibility (or primacy) by USEPA (1996b). As of June 2001, USEPA had delegated primacy for all well classes to 33 states, Guam, the Commonwealth of the Marianas Islands, and Puerto Rico. Seven states share primacy with USEPA, which administers UIC programs for the remaining states, the Virgin Islands, American Samoa, and Native-American lands.

10.6.3.2. USEPA groups underground injection into five classes for regulatory control. Each class includes wells with similar functions and construction and operating features so that technical requirements can be applied consistently to the classes. Injection wells utilized for aquifer remediation and experimental technologies are designated as Class V injections wells. Class V wells covered by the federal UIC program are authorized by rule and do not require a separate UIC permit. However, a Class V well regulated by a state UIC program may require a permit.

10.6.4. *Air Emissions*. Depending on the nature of the contaminants and the method used to treat the extracted fluids, it may be necessary to obtain an air discharge permit. For example, highly contaminated vapors extracted directly from the subsurface may require treatment. Common technologies include thermal or catalytic oxidation and vapor-phase granular activated carbon. Discharges to the atmosphere and downstream of ISTR operations are monitored and must comply with regulatory limits. Air or steam stripping may be used to treat the liquid stream by separating the NAPL or dissolved phase contaminant from the recovered groundwater. An air discharge permit may be required if the mass emitted exceeds discharge thresholds, as dictated by local, state or Federal law. Modeling also may be required to demonstrate that air quality at a potential receptor site is not above allowable standards (AATDF 1997).

10.6.5. *Wastewater and Sewer Discharges*. To maintain hydraulic control, or to dispose of liquid wastes, it is expected that some of the extracted and treated groundwater may need to be discharged to a municipal wastewater treatment plant (WWTP) (also called a publicly owned treatment works [POTW]) with a National Pollutant Discharge Elimination System (NPDES) permit, or via a direct NPDES permit.

10.6.6. *Preventing Uncontrolled Migration*. Hydraulic control and the prevention of contaminant migration beyond the treated area is a crucial element in the design and operation of an ISTR. Regulators and the public need assurances that ISTR will not result in the uncontrolled remobilization of a large volume of DNAPL.

10.6.6.1. A related concern, which is becoming more widespread as vapor intrusion mechanisms are better understood, is the possibility of uncontrolled migration of contaminated vapors into the basements of people’s homes or businesses during ISTR. Adding heat to the subsurface and raising the temperature of DNAPLs enhances their mobility and volatility, justifying these concerns. Thus, appropriately sized and engineered extraction systems and control is critical.

10.6.6.2. Groundwater and vapor concentrations must also be monitored down-gradient from the treatment zone to ensure that the ISTR system is not causing migration of contaminants out of the targeted treatment areas.